

XIII.—*A Month on the Trondhjem Fiord.*

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[Continued from vol. xii. p. 452.]

[Plates VI. & VII.]

Genus KINEKOSKIAS, Danielssen.

(Additional notes on the genus.)

Kinekoscias Smitti, Dan.

Add to the synonymy of my previous notes given on p. 448 of vol. xii. the following:—

1875. *Bugula flexilis*, Verrill, "Brief Contrib. XXXII. Results Dredging New England Coast, 1874," Amer. Journ. Sci. vol. ix. p. 415, pl. vii. figs. 1, 2.
1879. *Kinekoscias flexilis*, Verrill, "Recent Additions Marine Invert. N.E. Amer.," Proc. U.S. Nat. Mus. p. 189 (no description).
1879. *Kinekoscias Smitti*, Dub. & Kor., = *Bugula flexilis*, Verr., Verrill, Prelim. Check-List Marine Invert. Atlantic Coast, Cape Cod to Gulf of St. Lawrence, p. 29 (name only).
1885. *Kinekoscias* (*Bugulopsis*) *flexilis*, Verrill, "Results Explor. 'Albatross,' 1883," Ann. Rep. Comm. Fish and Fisheries for 1883, p. 530 (no description).—*Bugulopsis*, to which the species is here referred, is a genus established by Verrill, with *Cellularia Peachii*, Busk, as the type, upon the valid grounds that *Cellularia* of Busk is not Pallas's genus of that name.

Since the last part of these notes was published, having had occasion to refer to some of Verrill's papers, I came across his figure of *Bugula flexilis*, and was at once struck with the absolute identity of his illustrations and my own of *Kinekoscias Smitti*, and I find that he subsequently referred his species to that of Danielssen. Verrill speaks of the branches as "tapering gradually to the point of attachment," but makes no mention of a stalk; but even should the species assume a different habit on the other side of the Atlantic, the zoöcial characters being the same, there can, I take it, be no question as to the propriety of uniting the forms. It is interesting that Danielssen's species has its range thus extended. It occurs in deep water (194 fathoms) off the coasts of Maine and Nova Scotia. I have found a fragment labelled "*Kinekoscias Smitti*, = *Bugula flexilis*," which was sent to me by Professor Verrill. It is in spirit, but in bad condition, having been apparently at some time dried; but it appears to bear out the synonymy.

Kinikoskias arborescens, Danielssen, = *Bugula umbella*, Smitt.

It may be well, as I am noticing this genus, to refer also to this other northern species. *K. arborescens* has the zoarium attached not by one chitinous tube, but by many, and these are short; the zoarium is more calcareous than in *K. Smitti*, all the branches arch over and bend downwards, like an opened umbrella*, while the stems bear the proportionate height of its handle. The zoœcia are on the upper surface of the branches; they have their backs marked with curved lines, as represented by Dan. & Kor. On the front there is no spine-point at the upper outer angle, but, instead, this angle is the point for the attachment of the avicularium, which thus occupies a different position from that in the three other known species; the avicularium is much shorter and more tumid—Dan. & Kor. correctly say “it resembles an eagle’s head in shape,”—with the crown much arched.

The points I have mentioned distinguish this species from *K. pocillum*, Busk, of the ‘Challenger’ Expedition, as well as from the species here previously described. Specimens examined are from the Gulf of St. Lawrence (*Mr. Whiteaves*) and Kara Sea, ‘Dijmphna’ Expedition (*Copenhagen Museum*). This last specimen has œcia, which have not previously been observed. They are semiglobose and similar in character to those of the other species.

7. *Bugula Murrayana*, Johnston.

Rödberg.

Genus ELECTRA, Lamouroux, 1816

(type *Electra verticillata*, Lamx., = *Flustra pilosa*, Linn.).

= *Amphiblestrum*, Gray, 1848 (type *A. membranacea*, Abildg.†), =

* Busk is mistaken in supposing (*vide* ‘Challenger’ Report, p. 45) that Smitt has represented his specimen “the wrong way up in his figure.”

† Busk, in ‘Challenger’ Report, Cheilostomata, 1884, makes *Membranipora Flemingii* the type of *Amphiblestrum*. In order to understand this we must refer to his Cat. Marine Polyzoa in Brit. Mus., Cheilostomata, p. 58, where, in describing *M. Flemingii*, he makes *Flustra membranacea*, Abildg., a synonym. It is strange how he can have fallen into such a mistake, for there is nothing in Abildgaard’s description or figure applicable to *M. Flemingii*. The following words are important in that author’s description, which is confirmed by the figure:—“Cellulis marginæ calcareo cinctis, et membra hyalina tectis. In medio marginali basis prostat mucro elevatus plus minus elongatus, etc.”^a What, then, is

^a Abildgaard, in Müller’s Zool. Dan. vol. iii. 1789, p. 63, pl. cxvii figs. 1, 2.

Conopeum, Gray, 1848 (type *C. reticulum*, Gray *), = *Annulipora*. Gray (type *A. pilosa*, Linn.) = *Reptelectrina*, d'Orb. 1851 (type *R. dentata*, Sol. & Ell.) = *Electrina*, d'Orb. (type *E. lamellosa*, d'Orb.), = *Pyripora*, d'Orb. (type [recent] *P. ramosa*, d'Orb.), = *Electra*, Busk ('Challenger'), partim.

Zoecium more or less elongated, typically turbinate, the basal portion enclosed by a calcareous crust, which may be either punctate or entire; anterior portion consisting of an area oval or oblong in shape, covered by a thin membrane, at the summit of which is the oral opening; border of the area calcareous and often surmounted with spines, in which latter case one at the base is either the only one present or is usually larger than the rest. No oecia known in recent species. No avicularia. Larva a "cyphonautes." Zoarium either incrusting or erect and free.

The species are subject to extraordinary variation, and in certain conditions the basal portion becomes nearly or quite obsolete.

Other European species referable to the genus are *E. Lacroixii* (Aud.) (including *M. monostachys*, Busk) and *E. catenularia* (Jameson). There are many representatives in other parts of the world.

Electra verticillata, Lamx., has long been a puzzle to authors, and parts of the original figures have again and again been reproduced without any additional light being thrown on the species. Paul Fischer † and Smitt were the first who rightly referred it to *Flustra pilosa*, Linn. That this is the case, and that it owes its peculiar verticillate arrangement of the zoecia to the situation on which it was developed, is, I think, clear, though not hitherto explained. An examina-

Abildgaard's *Flustra membranacea*? It is most certainly the form figured by Smitt (pl. xx. fig. 46) as forma *membranacea* of *Membranipora pilosa*, and rightly referred by him to Abildgaard's species, and which has since been well figured by Freese ("Anatom.-histol. Unters. von *Membranipora pilosa*, Linn.," Archiv f. Naturg. 1888, pl. i. figs. 3, 4). There can be no doubt that these figures, however, do not represent *M. pilosa*, but *M. Lacroixii*, var. *monostachys*, a species which Levinsen has lately recorded as *M. monostachys* from the Baltic (Levinsen, Vidensk. Udbytte Hanechs Togter Polyzoa, 1891, p. 277), whence also the specimens of Abildgaard, Smitt, and Freese came.

* About twenty-five years ago I examined in Brit. Mus. the specimens which Gray had named *Conopeum reticulum*, and found that most of them at any rate were referable to *M. Lacroixii*, Aud., which, differing widely as it does from the type of *M. monostachys*, I am nevertheless unable to separate from certain undoubted forms of that so-called species.

† Fischer, "Bryozoaires, Echinodermes et Foraminifères de la Gironde," Actes Soc. Linn. Bordeaux, vol. xxvii. 1870, p. 15.

tion of the figures * shows it to be incrusting the main stem and extremities of the branches of some such seaweed as *Cladostephus verticillatus*, Lightfoot. The magnified view is taken from the extremity of a branch, and apparently the verticillate ramuli of the seaweed have compelled a corresponding verticillate arrangement of the zoecia of the polyzoon. I have seen such an arrangement, though not so marked, at the extremity of a zoarium coating a seaweed (Pl. VII. fig. 1). Moreover the quincuncial disposition of the zoecia is sometimes departed from in *Electra pilosa* without any apparent cause, since in the widest foliations of an erect flustriform variety of the species (var. *flustriformis*, specimen *a*, presently to be described), which I dredged at Florö, there occur many succeeding transverse rows of cells arranged parallelly side by side across the frond (see Pl. VI. fig. 6).

8. *Electra pilosa*, Linn., var. *carbasiiformis*, Norman. (Pl. VII. fig. 2.)

The only example of the species found was taken at Rödberg living absolutely free and in a "Hemescharau" state. It is described below under the above name, and is the only specimen I have ever seen or heard of in which this mode of growth has been assumed by the species.

I take this opportunity of directing attention to the extraordinary variation exhibited in this species. The variations may be divided into two classes—first, as regards the structure of the zoecia themselves, and, secondly, as affects the ultimate forms into which the zoecia arrange themselves. The zoecium is normally more or less produced at the base, and this basal portion is always, when present, beautifully punctate; in advance of this crustaceous hinder portion comes the area, usually ovate, sometimes nearly oblong, covered with a thin membrane, at the anterior end of which is the small mouth-opening; the enclosing calcareous margins of the area are almost invariably furnished with spines ranging from four to ten in number in different varieties on the lateral margin, and one at the centre of the hinder margin, rarely of the same size and character as those of the sides, but usually conspicuously larger and stouter, or converted into a setose appendage, which attains often gigantic proportions; and in one instance I have seen, in addition to this great seta, one, two, or three of the neighbouring lateral spines, together with the basal spine, changed into great setæ (Pl. VI. fig. 4).

* Lamouroux, Expos. méthod. des genres de l'Ordre des Polypiers, pl. iv. figs. *a*, A.

In a specimen incrusting the flat leaves of a *Fucus* the margins are much more thickened than usual, the zoecia have their areas brought close together, the hinder calcareous punctate portion of the zoecium being reduced to the small portion which gives support to the great seta, at the base of which a few puncta may still be seen; but here and there even these few are absent (Pl. VI. fig. 5). A remarkable modification in the opposite direction takes place in var. *Reaumuriana*, where the zoecia are elevated into a semierect position and the punctate crust is carried forwards and forms side walls on which rest the usual margins of the area (Pl. VII. fig. 1).

In the seas of our own islands this species has only been met with in an incrusting state, and Mr. Hincks has remarked* that "amidst all the varieties of this protean species from various parts of the world" he had never seen the erect free-growing form until he received a specimen from New Zealand. Nowhere have the seas been more closely examined for Polyzoa than around our own islands. It is therefore very curious that, while free-living states of this species are met with on the coasts of West France, of Belgium, and of Norway, no instance of such growth should have ever occurred in our seas.

There is also a very curious reproductive difference as connected with the genus *Electra* and forms which are certainly at least very closely allied. In the North Atlantic no ovicell has ever been known on any specimen of either of the three species which I would refer to this genus, *E. pilosa*, *E. Lacroixii* (including *M. monostachys*), and *E. catenaria*; and this fact has deep significance. Yet Mr. Waters has described from New-Zealand Tertiary beds forms so like to the foregoing that he has even referred them to the same species as *Membranipora monostachys* and *Membranipora Lacroixii*, var. *grandis*; in these reproduction takes place by means of oecia †. The absence of oecia in recent forms would not, moreover, seem to be confined to North-Atlantic species. I cannot recall to mind any out of many exotic recent species which I should refer to the genus in which oecia are known. It is probable therefore that Waters's species must find their place in another genus, notwithstanding the close resemblance of such a form as that shown in his fig. 3 to the genus *Electra*.

* Ann. & Mag. Nat. Hist. ser. 5, vol. x. 1882, p. 169.

† Waters, "Tertiary Cheilostomatous Bryozoa from New Zealand," Quart. Journ. Geol. Soc. vol. xliii. 1887, p. 45 (*M. monostachys*, pl. vi. figs. 6, 3; *M. Lacroixii*, var. *grandis*, pl. vi. fig. 1).

Section I. Adherent varieties.

Var. 1. *dentata*, Ell. & Sol. (Pl. VI. fig. 1).—Zoëcium more or less produced and punctate; margin of area crowned with spines, variable in number, usually from four to ten, rarely twelve, and one at the base larger and stronger than the rest, but, like them, calcareous. Very common in the British Isles, incrusting shells, stones, and weeds. (Busk, Brit. Mus. Cat. Cheilostomata, pt. ii. pl. lxxi. fig. 1; Hincks, Brit. Mar. Pol. pl. xxiii. figs. 2, 3.)

Var. 2. *tenuis*, Norman (Pl. VI. fig. 2).—This form corresponds in all respects with the last, except that it is more delicate in structure, the spines more slender, and the basal spine reduced in size, so as to be no larger than the others.

An extreme form of var. *tenuis* in my collection (formerly in Barlee's), incrusting a *Mytilus*, has the greater portion of the zoëcia wholly devoid of spines or setæ; other zoëcia have two or three little denticles (rather than spines); others resemble Hincks's pl. xxiii. fig. 4; while some few show the passage to the usual state of var. *tenuis*.

Forma *stellata*, Thompson.—This is either of the foregoing varieties living on the inside of bivalves or on broad-leaved seaweeds, and the zoarium growing out into digitate extensions at the margins, so that its form is more or less stellate.

Var. 3. *typica*, Norman, = var. *Læflingiana*, Moll (Pl. VI. figs. 3-5).—I have never seen this variety incrusting stones or shells, but always seaweeds. The zoëcia have the margins much stronger than in the preceding varieties; the posterior punctate portion is often reduced to a minimum, especially in the central portions of the zoarium, where the punctated structure is wholly absent or can only be seen at the base of the posterior spine. The lateral spines are usually six, stout and strong; the posterior central spine is greatly developed, sometimes still preserving its spine-like character, at another transformed into a great chitinous seta, which is two, three, or even four times the length of the zoëcium: when incrusting a flat weed these long setæ are developed most freely at the margins; when investing small round weeds the whole zoarium elegantly bristles with them, and sometimes two, three, or four spines are changed into the great setæ. (Blainville, Man. d'Actinol. pl. lxxv. fig. 2; Hincks, pl. xxiii. fig. 1.)

Var. 4. *Reaumuriana*, Moll, = *Electra verticillata*, Lamx.

(Pl.VII. fig. 1).—*Zoecia* much more delicate in structure than in the last variety, *semierect*, so that in most cases the punctate crust is to be seen not only on the hinder portion, but on the sides beneath the area; lateral spines mostly four, but sometimes six or eight; posterior seta of moderate length, equal to about two *zoecia*. The *zoecia* are more irregularly disposed than in any other variety, often one series is developed on the top of another, and here and there at the extremity of the branches they take on a verticillate arrangement; but this verticillate arrangement is rarely to be found, and I regard it in my specimens as purely accidental; but the tendency of the *zoecia* to erect themselves, and hence their form, and the four lateral spines clearly indicate this as the form described by Lamouroux. I have a large quantity of this variety clothing in every part masses of a small round branched weed about $3\frac{1}{2}$ inches high. It is part of that portion of my British collection which was Barlee's, but the locality has not been preserved. (Lamouroux, Expos. méth. Polypiers, pl. iv. figs. a, A; Moll, *Eschara*, ex Zooph. ord. genus 1803, pl. iv. fig. 6, A-E.)*

Var. 5. *hippotoiformis*, = var. *laxa* (Pl.VI. fig. 7), Hincks's names for Smith's pl. xx. fig. 49.—In this beautiful and most remarkable variety the zoarium consists of lines composed of a single series of *zoecia*, whence branches diverge right and left from every cell (normally) †; these branches also consist of cells in single file and give origin to other pinnulæ, thus in all respects conforming to the habit of *Hippothoa divaricata*. It runs over *Fuci* and is most fully and perfectly developed on their air-bladders. The following is the description of the arrangement of the *zoecia* in a portion of a specimen:—A main branch consists of a chain of 34 cells, the first twenty-five of which give origin, both on right and left, to branches, the structure thus being elegantly pinnate. We will now follow the course of three consecutive pinnæ on the left side. Pinna A ‡ 1-5, 6 (1), 7 (1), 8-12, 13-31 (1); from 13 to 31

* Moll's specimen had six lateral spines on the cells: that of Lamouroux four.

† To understand how this takes place, see Jules Barrois, 'Mém. sur l'embryol. des Bryozoaires,' 1877, pl. xv. fig. 6, where we have represented the "mother-cell" giving off the commencement of the three next cells, one in front and one from each shoulder. Each cell in var. *hippotoiformis* in this respect acts as the "mother-cell," giving off three buds, but the lateral, instead of being directed forwards, are directed outwards.

‡ A number as the first "1-5" means that the first five cells of the pinna have no branches, "6 (1)" means that the sixth gives origin to a branch (pinnula) on one side, "7 (2)" would mean that the cell gives rise to two pinnulæ, right and left.

the pinna runs side by side with pinna B, the cells touching those of B on the right; on the left and free side every cell gives origin to a pinnula. Pinna B, 1-3, 4 (1), 6-12 (2); now it comes into contact with pinnæ A and C, and passes between them, the three running side by side from 13-17; here pinna C has diverged to the right, but A is still to the left, so one side only is free and we have 18-29 (1). Pinna C, 1-5, 6-9 (1), 10, 11; here it is running along the side of B, which is on its left, so that on that side it cannot branch, and we have 12-18 (1); here it diverges from B to the right, and, being free, we have 19-29 (2), and then a terminating creeping base equal in length to six cells, on which the cells are imperfectly or as yet not at all developed. The zoecia are elongated both in the posterior calcareous portion and in the long and often nearly oblong area; the lateral spines are 4 or 6, rarely 8, the posterior spine is no larger than the others*; the branches diverge from what may be called the shoulders of the zoecium. In every case where a branch is not given off to right or left it is from want of room; the animal seems to discover by its tentacles that there is a neighbour too near to enable itself to develop a zoecium in that direction: but the direct onward growth of the main stem, pinna, or pinnula is not so easily stopped; it will run up close to the side of a neighbour and accompany it in its onward course (see Smitt's figure), or it will ride over its back, if at an angle, and pursue its journey. The pure white lace which this variety forms is a beautiful object seen against the black background of the *Fucus* on which it is developed. My specimens are from Florö, and it is not unlikely that those of Sars, which Smitt describes, were from the same locality, the fauna of which Sars knew so well.

Section II. Free-living forms.

Var. 6. *carbasiiformis* (Pl. VII. fig. 2).—Imagine the form *stellata*, Thompson, living absolutely free, consisting of a lamina composed of a single layer of zoecia, with calcareous back, and you have this variety. The specimen is 20 millim. in its greater and 16 millim. in its lesser diameter, the outline very stellate; the area of the zoecia has four, rarely six, or even eight spines on the margin, the posterior spine a little larger than the others. I can see no sign of attachment even at the "mother-cell." Rödlberg, Trondhjem Fiord, 1893.

* It was so in Smitt's specimen, and, of course, there may be this variation.

Var. 7. *flustriformis*, = var. *Ellisiana*, Moll.—The variety may or may not have originally invested a seaweed; in the former case the seaweed or hydrozoon having been covered, the zoarium develops free growth and forms flattened branches of greater or less width. The following notes will show wide divergence in the mode of growth of the branches of var. *flustriformis*.

Form *a* (Pl. VII. fig. 3) exhibits great difference in the character of the free branches in the same specimen: some are broad and leaf-like, of twenty to thirty zoecia in width; others ligulate; others so narrow as at first sight to appear to be round, but closer examination shows an ovate section, they are two or three zoecia wide. These narrow branches are at the base, but the expanded leaves have digitate terminations. The lateral spines are usually six, sometimes eight; basal spine not long on the central portion of the leaves, but produced into a rather long seta on their margins and on the narrower branches. Height $2\frac{1}{2}$ inches, not based at all on a seaweed. Batalden, which is a few miles from Florö, Norway, 1882.

Form *b* (Pl. VII. fig. 4). A dense bush, composed of a large number of stems springing from one base, and dichotomously and trichotomously branching; all branches and branchlets flat and narrow, mostly four to eight zoecia in breadth, but occasionally widening before again dividing to fifteen or even twenty zoecia. Armature as in the last, but many cells in the wider portion of one of the specimens wholly devoid of spines. Height 2 inches. Bukken, in the Bergen Fiord, 1878 (*A. M. N.*); Ostende (*Prof. E. van Beneden*).

When visiting the museum at Liège in 1892 I saw a great quantity of this form preserved in spirit, some of which, above described, Prof. E. van Beneden kindly gave me. He told me that it was very common on the coast. This is interesting, because Pallas, who wrote his excellent 'Elenchus Zoophytorum' 127 years ago, tells us that this present form was known in Belgium as "Zee-moss," and writes:—"Nullibi abundantiorum novi hanc Escharam, quam in Mari Belgium alluente. *Sertulariam longissimam*, ibidem copiosissimam et magnis acervis sæpe in littore conspicuam, in certis tractibus, maxime versus autumnum, totam incrustat, et ab extremis ejusdem ramulis insuper frondescens, elegantissimas formas assumit, primoque tunc aspectu *Spagnum palustre* fere æmularur. Sic incrustatæ hujus *Sertulariæ* immanis vis incunte imprimis hyeme Ann. 1764 in tota occidentali Belgii ora, a flantibus Austris egerebatur, ut in brevi passim spatio, ad onerandum vehiculum sufficere potuissit" (p. 51).

Form *c* (Pl. VII. fig. 5).—Based on a seaweed, from which

base, when covered, have arisen hundreds of free strap-formed branches, usually simple, very rarely dichotomously divided. The uniform strap-shape of the branches and their nearly uniform breadth of three to five zoœcia, and length of about half an inch, give to this specimen a very marked character. The zoœcia are always quincuncially arranged, and have six strong lateral spines, the basal spine as a long seta. Height 5 inches. Picked up on the sands at Cap Breton, S.W. France, in 1880 (*A. M. N.*).

Var. 8. *cellariiformis* (Pl. VII. fig. 6).—A most elegant form. A little bush with erect, *round* branches; the undivided branches are from $\frac{1}{2}$ to $1\frac{1}{2}$ inch long, but seldom more than half a millimetre in diameter; built up generally of four rows of zoœcia, which are rather more elongated than usual, with 4 or 6 lateral spines, and the basal spine slender but not setiform. Height 2 inches. Florö Bay, Norway (*A. M. N.*).

Var. 9. *gemellariiformis* (Pl. VII. fig. 7).—Here we meet with *E. pilosa* performing a most extraordinary gymnastic feat. Two zoœcia stand back to back, shoulder to shoulder; on them mount two similar zoœcia, and so the main stem is built up of pairs of cells; then from both right and left shoulder of every cell stands out at nearly a right angle a cell, which is back to back again with the cell which has been developed from the opposite side of the main stem, and the growth of the branches proceeds as that of the main stem; and in this way an erect pinnate structure is built up, ultimately becoming bipinnate, and even tripinnate, and the whole composed of only a double row of cells. Zoœcia and spines as in the last. Florö Bay, Norway, 1882 (*A. M. N.*).

Var. 10. *eucrateiformis* (Pl. VII. fig. 8).—This is var. *hippotoiformis* living free, the entire structure being formed of a single series of cells and pinnately branched. In this case, however, the branches are few and the general appearance is of a mass of long chains lying heaped together. Found with the many other remarkable forms in Florö Bay.

Vars. 1 to 4 are British forms, the rest are not yet known in our fauna.

The truly marvellous forms above described exhibit an amount of variation in *Electra pilosa*, to which I know no counterpart in the whole range of marine zoology, or, indeed, in any other animal. One extraordinary circumstance at once strikes us. There seems to be common mind at work

and exhibited by the members of a colony, who determine to erect their building after a special and prearranged plan. This is no case of inherited instinct which prompts the members of a family to act together to build as their fathers built; but the founder of a colony settles the course she will adopt, and this determination, it would seem, must somehow be communicated by means of the colonial nervous system, and be acted upon by all the descendants to whom she gives birth by gemmation. Natural selection cannot account for this. A very difficult problem is here presented to us. We cannot appeal to vast periods of time. We see enormous changes brought about apparently at the will of individuals, who, building colonies after the various fashions characteristic of a large number of genera belonging to the same class as themselves, simulate the general forms of a *Membranipora*, a *Hippothoa*, a *Carbasea*, a *Flustra*, a *Cellaria*, a *Gemellaria*, and a *Eucratea* *.

Bugula Murrayana is another species given to "sports." The *Menipea fruticosa*, Packard (= *Cellularia quadridentata*, Lovén), has been often regarded as a distinct species, differing from the type in its narrower fronds, fewer spines, and absence of large lateral avicularia; but the reason I refer to this species is not on account of that variety, but because it also is known to take on a *Eucratea*-like form, composed of a line of single cells. This curious variation is figured by Smitt (pl. xviii. fig. 27), and I have also myself met with it.

I have used the word "sports" advisedly in the preceding sentence, because the remarkable variations of *Electra pilosa* seem to find a parallel in the "sports" of plants.

Genus RAMPHONOTUS †, gen. nov.

The zoœcia, if developed freely in form, remind us of those of *Electra*, being turbinate, with a calcareous part posterior

* It has been argued by recent writers that the form which the colony of a polyzoon belonging to the Cheilostomata assumes is of no moment in generic character. *Electra pilosa* lends strong support to this view. Yet it is a view nevertheless in which I am not prepared in all cases to acquiesce. The zoœcial characters are unquestionably all important, but no lasting classification can be based on any one part of the zoœcium, whether it be the mouth-opening, wall, rosette-plates, or anything else. Why also in all instances is the ultimate growth and form of the zoarium to be excluded from generic character among certain families of the Cheilostomata, and at the same time to be recognized among the Cyclostomata and Ctenostomata, and even other groups of the Cheilostomata? This is surely scarcely consistent. In some instances, as, for example, *Electra pilosa*, the form of the colony is of no generic or specific value, but in other cases it may be and, I believe, is.

† *ῥάμφος*, a bird's beak, and *ῥῶτος*, the back.

to the area, widening upwards from the base; but ordinarily, in their crowded state, only a sufficient part of this posterior portion remains to support the avicularium; the area is nearly as wide as long and often somewhat trifoliate in form; the mouth-opening is a slit close to its anterior margin, the border surrounding the area is calcareous and may be armed with spines. Oecia large, globose, and imperforate. An avicularium of large size (sometimes monstrously so), with acute mandible, would seem to be habitually present on the adult zoecia, situated on the central portion of the zoecium on or immediately behind the hinder margin of the area, and is often elevated on a pedestal. [Zoarium incrusting in type species.]

Type, *Ramphonotus minax* (Busk).

This genus approaches *Foveolaria*, Busk; but the first species (type) described (*F. elliptica*, Busk) would seem to have a regularly articulated large operculum, besides other points of distinction.

9. *Ramphonotus minax* (Busk).

Membranipora Flemingii, forma *minax*, Smitt, Öfvers. K. Vet.-Akad. Förhand. 1867, p. 367, pl. xx. figs. 43, 44.

Membranipora minax, Hincks, Brit. Pol. p. 169, pl. xxii. figs. 2. 2 a-c.

On a stone from about 100 fathoms, Rødberg. I also have it in my collection from Shetland, Hardanger and Bergen Fiords, Norway (*A. M. N.*), Gulf of St. Lawrence (*Whiteaves*).

Hincks was of opinion that Smitt's figure 44 could not belong to this species; but it gives an accurate representation of the avicularium in the fully developed state.

10. *Tessarodoma gracile*, M. Sars.

1851. *Pustulipora gracilis*, M. Sars. Beret. om en i Somm. 1849, Zool. Reise i Lofoten og Finmark, Nyt Mag. f. Naturvidens. p. 26.

1860. *Onchopora borealis*, Busk, Quart. Journ. Micr. Sci. vol. viii. p. 213, pl. xxviii. figs. 6, 7.

1863. *Quadricellaria gracilis*, M. Sars, Beskr. over nogle norske Polyzoer, Videnskabs Förhand. for 1862, p. 14 (separate copy).

1864. *Quadricellaria gracilis*, Alder, "New British Polyzoa, &c.," Quart. Journ. Micr. Sci. n. s., vol. iv. p. 7 (separate copy), pl. ii. figs. 9-12.

1867. *Anarthropora borealis*, Smitt, "Krit. Förteck. Skand. Hafs-Bryozoer," Öfvers. af K. Vet.-Akad. Förhand. p. 8, pl. xxiv. figs. 25-29.

1869. *Tessarodoma gracile*, Norman, "Last Report Dredging Shetland," Brit. Assoc. Rep. for 1868, p. 309.

1873. *Tessarodoma boreale*, Smitt, Florida Bryoz., Kongl. Svens.

Vetens.-Akad. Handl. vol. xi. p. 32 (separate copy), pl. vi. figs. 143-145*.

1880. *Porina borealis*, Hincks, Brit. Polyzoa, p. 229, pl. xxxi. figs. 4-6.

1884. *Tessarodoma boreale*, Busk, Report 'Challenger' Polyzoa, I. Cheilostomata, p. 174, pl. xxiv. fig. 8.

On the precipices at Rödberg.

This genus differs from *Porina*, d'Orbigny, in having:— (a) oœcia; (b) avicularia; (c) a row of large marginal pores ("origelles"). The oœcia, figured by Alder, are very rarely developed—in not one in a dozen specimens could I find them at all; they are, if present, only to be seen on the very young cells at the extremity of the branches; they are very small, with a granulated surface, and immediately become wholly immersed and invisible by overgrowth of the surface of the zoarium, while at the same time the tubular orifice goes on developing and keeps well above the surface. The avicularia also will be seen best on the young cells; but the presence of these is constant or nearly so.

With respect to the specific name, it seems to me that the one given by Sars should be used. He first described the species, and Busk, in ignorance of the fact, redescribed it; both assigned it to a wrong genus: Sars called it a *Pustulipora*, Busk an *Onchopora*. Sars was the first to correct his own mistake and Busk's, and, although there was a previous *Pustulipora gracilis*, Milne-Edwards, in justice I think Sars's specific name should be retained.

Genus HEMICYCLOPORA, gen. nov.

Zoœcia with pores confined to the sides and sometimes anterior portion of front wall. Mouth-opening well arched above, lower margin straight (no denticle within the lip). Reproduction by oœcia, which are imperforated. No avicularia. No special pore ("fenestrelle").

Type, *Hemicycloporea polita* (Norman).

11. *Hemicycloporea polita* (Norman).

Discopora emucronata, Smitt, Ofvers. af Kong. Vetensk.-Akad. Förhand. 1871, p. 1129, pl. xxi. figs. 27, 28.

Lepralia polita, Hincks, Brit. Pol. p. 315, pl. xxxii. fig. 5.

* Busk questions whether Smitt's "fig. 143 and the lowermost zoœcia in fig. 144 really form part of *Tessarodoma* at all, or have merely become accidentally associated with it. The latter figures at any rate might well be regarded as *Lepralia (Porina) ciliata*." Certainly the semicircular oral opening is very different from the circular form which always prevails in the youngest cells at the extremities of the branches in *Tessarodoma*, and there are no lateral pores shown in the figures in question.

This genus comes very near to *Mucronella*, but differs in the absence of the denticle ("lyrula"). Hincks placed the type in *Lepralia*, but with doubt. *Discopora stenostoma*, Smitt, is also referable to this genus.

On a stone from deep water, Rödberg. Other specimens in my collection are the types from Shetland, 70-100 fath.; the Minch; Greenland ('Valorous' Exped.); Parry's Island, Spitsbergen, 20-70 fath. (Smitt, as "*Discopora cmucronata*").

12. *Schizoporella Alderi*, Busk.

Deep water, Rödberg.

13. *Schizoporella linearis*, Hassall.

On stems of Hydroids, Rödberg.

14. *Mucronella ventricosa*, Hassall.

On a stem, deep water, Rödberg.

15. *Mucronella abyssicola*, Norman.

With the last.

16. *Mucronella laqueata*, Norman.

Discopora coccinea, forma *ovalis*, Smitt, "Krit. Förteck. &c.," Öfvers. af K. Vet.-Akad. Förhand. 1867, p. 27 (separate copy), pl. xxvii. fig. 175 (vix fig. 174, quæ forsân ad *Mucronellam abyssicolam* referenda est).

Precipices, Rödberg, on stone.

17. *Porella compressa*, Sowerby.

On the precipices, Rödberg.

18. *Porella concinna*, Busk.

On shell, 40 fath., Rödberg.

19. *Porella bella*, Busk.

1860. *Lepralia bella*, Busk, Quart. Journ. Micr. Sci. vol. viii. p. 144, pl. xxvii. figs. 2, 3.

1868. *Escharella Landsboroviï*, Smitt, "Krit. Förteck. &c.," Öfvers. K. Vet.-Akad. Förhand. 1867, p. 12 (separate copy), pl. xxiv. figs. 60-65 (nec figs. 66, 67, nec *Lepralia Landsboroviï*, Johnston).

1880. *Smittia bella*, Hincks, Brit. Pol. p. 352, pl. xlii. figs. 7 and 9.

1880. *Porella concinna*, Hincks, var. *gracilis*, ibid. p. 324, pl. xlvi. fig. 9.

1889. *Porella concinna* (nec Busk), Hincks (partim), "Polyzoa St. Lawrence," Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 428, pl. xxi. fig. 4.

Zoecia generally elongated—longer in proportion to breadth

than in *P. concinna*—varying in colour from brownish yellow to red, very rarely white; whole front wall punctate, the pores round the base being larger than the rest.

The oral opening shows the following variations:—In the youngest state it is semicircular, the lower margin straight (Microporellidan); then a sinus is developed on the lower margin (and it is Schizoporellidan); next a bifid tooth appears within the sinus (it is now Mucronellidan); then the round avicularium is developed in front of the bifid denticle, which last appears to be taken into the wall of the avicularium (and it is now typical Porellidan); lastly, a denticle is sometimes, but rarely, developed again within the avicularium and is seen behind it (and the orifice is now typically Smittian).

Nor are these all the variations, for others occur in the position of the oral avicularium: this sometimes is so deeply seated that it cannot be seen at all from the front, and is only found by looking down into the throat; a large form of the species having the zoëcia measuring 1 millim. long instead of 0·6 to 0·7 millim., which is the usual size, which I have from the St. Lawrence and Greenland, seems always to have the avicularium in this position; this form may be called var. *grœnlandica*; next and typically it is seen just within the oral margin; lastly, sometimes it is on the margin, which it interrupts.

The oëcia are very little raised and granulated. Overgrowth takes place with certain variations:—(a) A thick crust is developed over the zoëcia, in which the punctations are even more conspicuous than in the first cell-wall; the form of the zoëcia is preserved. (b) The zoarium is covered with a similar punctate crust to the last, but here the hollows between the zoëcia are filled up, the surface becomes nearly flat, and on it the zoëcia are mapped out by means of narrow raised marginal lines.

I have a pretty variety from the St. Lawrence (*Whitcaves*). The zoarium is a Hemescharan free form; its surface is nearly flat, the zoëcia not being so much raised as usual; the punctations are all over the surface and conspicuous, except on a granulated fillet, which, raised above the general surface, completely and evenly encircles the mouth.

This species may be distinguished from *P. concinna* by its punctate front wall, as well as by its form, colour, &c. The latter species always has the general surface of the front wall imperforate and granular, though it has "origelles" (pores) at the base; the form of the zoëcia is almost invariably shorter, and consequently wider in proportion; the colour is usually

white, though sometimes, as at Guernsey, it is pinkish or pale brownish yellow.

Specimens of *P. bella* are in my collection from Shetland (*Barlee and A. M. N.*); Aberdeen (*the late Robert Dawson*); Bergen and Hardanger Fiords, Norway (*A. M. N.*); Greenland (*'Valorous' Exped.*); Gulf of St. Lawrence (*Whiteaves*).

What is *Lepralia Belli*, Dawson? As few persons would have the opportunity of consulting the paper in which the species is described, I give here its characters:—

“In large patches. Young cells granular, semihyaline, confluent; mouth immersed, sinuated, with a vibraculum or avicularium inside the middle of the lower lip; ovicells rounded, granulous like the cells. Old cells white, opaque, flat above, and separated by a deep sinuous furrow. Cells having a strong tendency to form rows radiating from the centre of the patch. It is allied to *L. concinna*, Busk, but differs in essential points from his description and figure.”*

Now the words “Young cells granular, semihyaline,” apply very accurately to *Porella concinna*, but not at all to *P. bella*, Busk. Mr. Hincks, in Brit. Pol. pl. xlv. fig. 6, figures from a Canadian specimen—authoritatively named?—*Porella concinna*, var. *Belli*. It represents accurately a common overgrown state of *P. concinna*, which is very different from the same condition of *P. bella*. I have before me a mounting, belonging to Mr. Whiteaves, who would certainly know Dawson's species, which exactly corresponds with Hincks's figure, and is labelled “*Lepralia Belli*.” I think therefore there can be no question that Dawson's species is a synonym of *P. concinna*. Mr. Hincks has hitherto united the forms which I have here deemed distinct, *P. concinna* and *P. bella*; but I think his second opinion was, at any rate, mistaken when in a recent paper † he transferred the *L. Belli* of Dawson from the form to which he had at first assigned it, and applied it to one which is undoubtedly what I call *P. bella*. Of course it is quite possible that Dawson may have confused the species and

* Described by Principal Dawson in “Contributions to Canadian Natural History by W. S. M. d'Urban and Robert Bell” (extracted from the ‘Report of the Canadian Survey’ for 1858), 1860, p. 33. Two other new forms are in this paper described by Dawson—*Hippothoa expansa*, which subsequently, ignorant of this paper, I by a singular coincidence described under the same name; and *Lepralia plana*, afterwards named by Smitt *Myrionozoon coarctatum*.

† Hincks, “Polyzoa of the St. Lawrence,” Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 428, pl. xxi. fig. 4.

sent *P. bella* to Mr. Hincks as his *P. Belli*; but, if so, it will not accord with Dawson's own description.

20. *Smittia Landsborovii*, Johnst.

An example taken at Rödberg with small round avicularium and bifid denticle. It does not bear any oöcia, to prove whether these are punctate or not. Neither Johnston's nor Busk's figures show any ovicells; they are both, it would seem, drawn from Landsborough's specimen, now in the British Museum. Busk (Cat. Mar. Pol., Cheilostomata, pl. cii. fig. 1) figured as *S. reticulata* a form which seems indistinguishable from *Smittia Landsborovii*.

The figure which was next supplied to us was by Alder (Quart. Journ. Micr. Sci., n. s., vol. iv. pl. iv. figs. 1-3); here for the first time we have the oöcium as well as the round oral avicularium, together with a larger spatulate avicularium which he found scattered here and there among the cells. The oöcium is figured as *punctate*. It is punctate in every specimen I have seen from the British Islands; it is punctate also in *S. crystallina*, Norman, and in *Escharella porifera*, Smitt, forma *typica*, which I regard as another form of my species. *S. crystallina* may always be distinguished from *S. Landsborovii*, of which it is at least a marked northern form, and I think specifically distinct. But *Escharella porifera*, Smitt, forma *majuscula* and forma *minuscula*, differ from all the preceding in having the oöcia *imperforate*, and, as compared with *S. Landsborovii typica*, the zoöcia are more tumid and the front wall more densely punctate. I propose to call this form

Smittia arctica, sp. n. (type *E. porifera*, var. *majuscula*, Smitt).

Escharella porifera, var. *majuscula*, Smitt, Krit. Förteck. Skand. Hafs-Bryoz. pt. iv. 1867, p. 9, pl. xxiv. figs. 36-38, and forma *minuscula*, figs. 33-35.

Forma *majuscula*: Kingsbay, Spitsbergen, 172 fath. (Smitt); Greenland ('*Valorous*,' 1875); Gulf of St. Lawrence (*Principal Dawson*).

Forma *minuscula*: Gulf of St. Lawrence (*Whiteaves*). All in Mus. Nor.

21. *Smittia trispinosa*, Johnston.

Trondhjem and Rödberg.

Fam. Celleporellidæ.

= *Diazeuxidées*, J. Jullien (Cap Horn).

Genus CELLEPORELLA, J. E. Gray, 1848.

1848. *Celleporella*, Gray, List Brit. Anim. Brit. Mus., Radiated Animals, p. 128.1888. *Diazeuxia*, J. Jullien, Miss. Scien. Cap Horn, Bryozoaires, p. 28.

M. Jullien, in the synonymy of the genus, gives "*Celleporella*, Gray (partim)"; but the only species which Gray placed in his genus was *C. hyalina*, and Jullien's name is an absolute synonym of the before-described genus.

Jullien has drawn attention to the striking features in this genus, not only as shown in the larval state and early development, for the elucidation of which we are indebted to the admirable work of J. Barrois, but also to the fact that the erect oœcia, which are developed in great profusion on the heaped-up central portion of the colony, are not on the summit of polypide-bearing cells, but of small cells connected with the reproductive function. Jullien's work should be consulted with respect to the genus, as I have only referred to the more remarkable characters. Levinsen, though apparently unacquainted with Jullien's work, has more recently added to our knowledge by illustrating the mode of growth of the oœcium-cells (Levinsen, 'Hauchs' Togter Polyzoa,' 1891, p. 286, pl. iii. figs. 10-15).

22. *Celleporella hyalina*, Linn.

Trondhjem, on shell.

Var. *catenifera*, Norman.

This name may be given to a variety from Florö, Norway. It is very prettily reticulated, the cells being separated from each other by a regular chain-like interstitial development, the openings in which are oval, arranged in single file. It is an intermediate form between *C. hyalina* and *C. discreta* (Busk)*; in the latter the interspaces are wider and the openings not arranged in such regular order.

* Jullien (Cap Horn Bryoz. p. 33) has renamed this *Diazeuxia reticulans*, quoting as a synonym "*Lepralia hyalina*, var. *discreta*, G. Busk"; but Busk (B. M. Cat. Polyz., Cheilos, p. 85) has given no such varietal name; he described a species, *Lepralia discreta*, and his specific name must therefore be retained.

Jullien has united *Hippothoa patagonica*, Busk, with *C. hyalina*. The North-Atlantic species of *Hippothoa*, *H. divaricata*, *H. flagellum*, and *H. expansa*, all have the oœcia borne on imperfectly-developed cells, and the latter often has the zoœcia in clusters instead of following the usual unicellular arrangement. If *Hippothoa* is not to be united with *Celleporella* (*Diazeuxia*, Jullien) it certainly comes very near it. Since Jullien apparently declines even to place them in the same family, it is better to wait for his further views rather than at once merge *Celleporella* in the earlier genus *Hippothoa*. Jullien states that there is only one European genus and species of his family *Diazeuxidées*; and of *Hippothoa divaricata* he writes:—"Smitt déjà avait indiqué l'*Hippothoa divaricata*, Lamouroux, comme étant une variété de sa *Mollia hyalina*, qui n'est autre que la *Cellepora hyalina*. Mais l'*Hippothoa divaricata* est tellement différente de la *Cellepora hyalina*, que je me refuse à admettre cette manière de voir."

I quite agree in not uniting these species; the zoœcia of *H. divaricata* are much more produced, and the oœcia are imperforate, while in *C. hyalina* they are always punctated; but Jullien has not yet explained why he does not unite the genera, nor referred in any way to the similarity of the oœcium-cells exhibited in *Celleporella* (*Diazeuxia*) and *Hippothoa*. The illustrations which he gives of the oœcium-cells of *D. hyalina*, var. *patagonica*, closely accord with those of *Hippothoa*.

23. *Hornera lichenoides*, Linn.

On the precipices at Röddberg.

24. *Hornera violacea*, M. Sars.

Röddberg, on precipices.

25. *Idmonea atlantica*, E. Forbes.

Röddberg, 70-250 fathoms.

26. *Stomatopora dilatans*, Johnston.

On a stone, deep water, Röddberg.

27. *Diastopora obelia*, Johnston.

Röddberg.

28. *Lichenopora hispida*, Fleming.

Trondhjem and Röddberg.

29. *Barentsia gracilis*, M. Sars.

On a hydroid, Rödberg.

30. *Rhabdopleura Normani*, Allman.

A single specimen on a *Serpula*, precipices, Rödberg. I sought in vain for this species on the *Lophohelia* at Rödberg, on which coral I had dredged it in the Hardanger Fiord, where it is also found on the tests of Ascidians.

The literature of this remarkable genus is becoming voluminous. In the latest paper, by Mr. G. H. Fowler*, that author says, "As to the affinities of *Rhabdopleura* in one direction there can be no doubt. Every positive anatomical feature which it possesses points to a close relationship to *Cephalodiscus* and *Balanoglossus*, while it only differs from these forms negatively, namely, in the absence of two important structures, gill-slits and proboscis-pore." He then arranges these genera as three groups of the Hemichordata. He adds that "there is another possible alliance, obscure and confused at present," to the genus *Phoronis*.

Thus *Rhabdopleura* is to take its place, according to Mr. Fowler, in the Phylum Vertebrata; on which Lankester's views are thus summarized in the latest edition of the 'Encyclopædia Britannica,' article "Vertebrata":—

Phylum VERTEBRATA.

- Branch a. CRANIATA (Cuvierian Vertebrata).
- „ b. CEPHALOCHORDA (*Amphioxus*).
- „ c. UROCHORDA (Tunicata).
- „ d. HEMICHORDA (*Balanoglossus*).

Into the last Branch Fowler, in his paper, removes *Rhabdopleura* and *Cephalodiscus* from the Polyzoa, to keep company with *Balanoglossus*, its only previous occupant.

Lankester says, "*Balanoglossus* gives the most hopeful hypothetical solution of the pedigree of Vertebrata;" and, as emphasizing the high interest which attaches to these remarkable animals, I would call to mind that previously to *Balanoglossus* being thus placed in the Phylum Vertebrata, Gegenbaur had instituted an entirely new phylum in the animal kingdom for its reception under the name of *Enteropneusta*. On the other hand, the larva of *Balanoglossus* ("*Tornaria*") seems to point to affinity with the Echinoder-

* G. Herbert Fowler, "The Morphology of *Rhabdopleura Normani*," Festschr. z. siebenzigsten Geburtstage Rudolf Leuckarts, 1892, p. 293, pl. xxx.

mata, while those of *Rhabdopleura* have as yet evaded the most careful search, and that of *Cephalodiscus*, from the habitat of the animal, 245 fathoms in the Strait of Magellan, is not likely soon to come under the section-knife of any naturalist, unless one is forthcoming—even more ardent than those two able men, Lankester and Harmer, who at different times have spent their summer holidays on the Hardanger Fiord, seeking, but in vain, for light on the developmental history of *Rhabdopleura*—who is willing to devote a year in the journey to and search at *Cephalodiscus*'s far distant and inhospitable home.

[To be continued.]

EXPLANATION OF THE PLATES.

PLATE VI.

All figures illustrate *Electra pilosa*, Linn.

- Fig. 1.* Var. *dentata*, Ell. & Sol., an ordinary form of this variety. In the zoœcia figured the oral aperture has fallen inwards and left a gaping aperture, which does not therefore represent the proper mouth-opening.
- Fig. 2.* Var. *tenuis*, Norman.
- Fig. 3.* Var. *typica*, Norman; a condition of this variety incrusting a round stem in which the basal setæ are of great length.
- Fig. 4.* A single zoœcium from the same specimen as the last, in which two lateral spines, as well as that at the base, are converted into long setose appendages.
- Fig. 5.* Var. *typica*, Norman. From the central portion of a specimen coating a frond of *Fucus serratus*: at the lateral margins the long setæ are developed, and a punctate portion of the base of the cell is visible, while in the central part of the zoarium (that is, on the side of the frond of the *Fucus* which it incrusts) the zoœcia (as here figured) are oblong, and consist only of the area and bounding walls, the basal punctate portion being wholly absent; the lateral spines short, stumpy, and strong, and usually upright; the basal spine is strong and also erect.
- Fig. 6.* Three zoœcia from each of three rows running across the broad part of a frond of var. *flustriformis* from Batalden, showing an unusual parallel arrangement instead of the quincuncial order which usually prevails.
- Fig. 7.* Var. *hippotoiiformis*, Norman; Florø, Norway. The cells of the main stem in the part figured are for some reason in an abnormal condition, and constricted at the origin of the pinnæ. The figure is somewhat diagrammatic, because I have not seen the pinnule commence so low down as on the first or second zoœcium; they may be expected about the fifth, but apparently the only cause for this is want of room; but in the drawing for a similar reason, "want of room," the illustration of what subsequently takes place at a greater distance from the main stem in reality has been here given nearer the origin of the pinnæ.

N.B.—The figures on the Plate are drawn to different degrees of enlargement.

PLATE VII.

All figures illustrate the varieties of *Electra pilosa*, Linn.

- Fig. 1. Var. *Reaumuriana*, Moll. The tip of a coated stem from the specimen which was procured by George Barlee. The punctate wall will here be seen extended forwards along the sides of the area.
- Fig. 2. Var. *carbasiformis*, Norman. Natural size.
- Fig. 3. Var. *flustriformis*, Norman. Form *a*. One of the broad branches of the specimen from Batalden; natural size.
- Fig. 4. Var. *flustriformis*, Norman. Form *b*. A portion of the specimen from Bukken, Bergen Fjord; natural size.
- Fig. 5. Var. *flustriformis*, Norman. Form *c*. A fragment of the specimen from Fosse de Cap Breton, Bay of Biscay; natural size. The central portion of this fragment consists of the *Electra* coating a seaweed: the strap-like terminations are the Polyzoön in a free state.
- Fig. 6. Var. *cellariiformis*, Norman. A fragment of a specimen from Florö, Norway; the ramifications, which would naturally be all erect, have been outspread for the purpose of more clear illustration. Natural size.
- Fig. 7. Var. *gemellariiformis*, Norman. Florö, Norway. Natural size.
- Fig. 8. Var. *eucrateiformis*, Norman. Florö, Norway. Natural size.

BIBLIOGRAPHICAL NOTICE.

Les Coquilles des Eaux douces et saumâtres de France. Par ARNOULD LOCARD. Svo. Paris, 1893.

THIS work in scope and method is similar to 'Les Coquilles marines des Cotes de France.' by the same author. In the 'Annals' for January 1892 we offered some remarks upon that volume, which, in a great measure, are applicable to the book before us.

It consists of 327 pages of text, containing brief descriptions of the families, genera, and the innumerable so-called species, and is illustrated with about three hundred not very good figures. The descriptions of the families and genera average about two lines each, and contain no mention whatever of the soft parts or animals; so that their true value may readily be estimated. The *specific* (!) descriptions in hundreds of cases are nothing more than mere diagnoses of individual specimens or groups of specimens belonging to one and the same species from different localities.

The rate at which the number of species increases in France is truly miraculous! Let us take two instances. M. Moquin-Tandon in 1855 recognized only five indigenous *Anodonta*; in 1882 M. Locard enumerated 109 species, but a decade later this number has increased to 279. One author in 1882 was content with the modest number of 31 species of *Limnæa*, but now 127 are required to satisfy him! Of this genus M. Moquin-Tandon recorded but seven distinct forms.